US EPA Mid-Continent Ecology Division

Research Project Summary

IAG with USGS EROS Data Center: Development of Tools for the National Elevation Dataset Hydrologic Derivatives

Overview

The goal of this project is to provide the necessary spatial databases to facilitate probabilistic sampling designs at the watershed scale, as this is the scale at which aquatic resources are managed, the scale at which Total Maximum Daily Loads and response to load reductions must be assessed, and the scale at which Unified Watershed Assessments must be conducted to set priorities for watershed restoration. One major limitation to implementation of a watershed-based monitoring program has been the lack of a nationwide digital database of watershed boundaries at the scale of proposed 12-digit HUCs, e.g., small watersheds of 10,000 to 40,000 acres (Fig. 1).

This interagency agreement with USGS EROS Data Center supports geographic information system (GIS) tools development for Phase III of a project by USGS to develop a consistent nationwide digital spatial database of small-watershed boundaries (the National Elevation Dataset-Hydrologic Derivatives or NED-H). NED-H (currently known as EDNA - Elevation Derivatives for Nationwide Application) is an interagency effort with its goal the development of a hydrologically correct version of the National Elevation Dataset (NED) and systematic derivation of standard hydrologic derivatives at a scale of 1:24,000 (Fig. 2). The quality and wall-to-wall coverage of available high resolution digital elevation data, the development of the National Hydrography Dataset (NHD), and advances in GIS application of terrain modeling have made possible the development of these derivative data layers.

The initial phase of the full NED-H production, reach level catchment delineation, has been completed through an MOA between USGS EROS Data Center and the National Weather Service (Fig. 3). Phase II, currently underway, involves USGS and State/agency partners in an intensive comparison of 1:24,000 digital raster graphics and the digital elevation model (DEM) generated watershed boundaries and synthetic streamlines with the 1:100,000scale NHD streams. Discrepancies are then flagged for subsequent correction in Phase III through minor modifications in the DEMs. These hydrologically-corrected DEMs reflect the true nature of flow across the DEM surface. This interagency agreement provides for the development of tools for Phase III, the testing of these tools throughout the development process, and the establishment of a Web service to provide Phase III tools and datasets to stakeholders (Fig. 4).

Development of a user-friendly web-based interface for data viewing and delivery will: 1) support development of watershed-based sampling frameworks, 2) identify probable (upstream) causes of impairment for impaired waterbodies, and 3) locate potentially impaired waterbodies and predict associated causes and probabilities of impairment. Current technology supports the use of distributed data networks for downloading GIS coverages and "point-and-click" dynamic GIS processing -- i.e. simple selection of a stream point will provide the user with watershed boundaries and associated data layers (e.g. land use, climatological data, impervious surface area)

for that (newly defined) watershed. We will also georegister USGS gaging stations to EDNA synthetic stream networks to help elucidate relationships among watershed attributes and historic flow data. A prototype Internet Map Service has been established for the Lake Michigan basin, although many of the tools and products incorporated are also available and applicable nationwide (Figure 5).
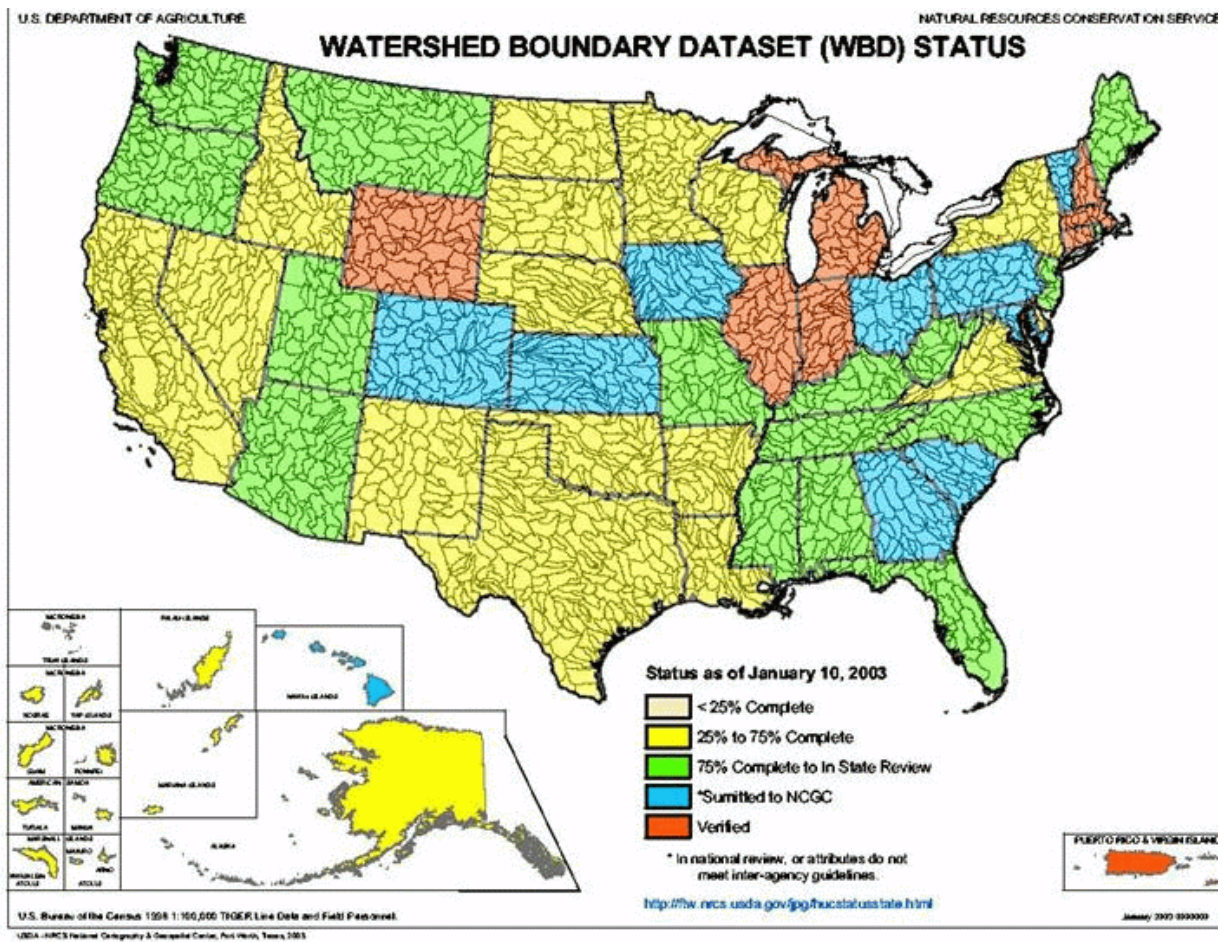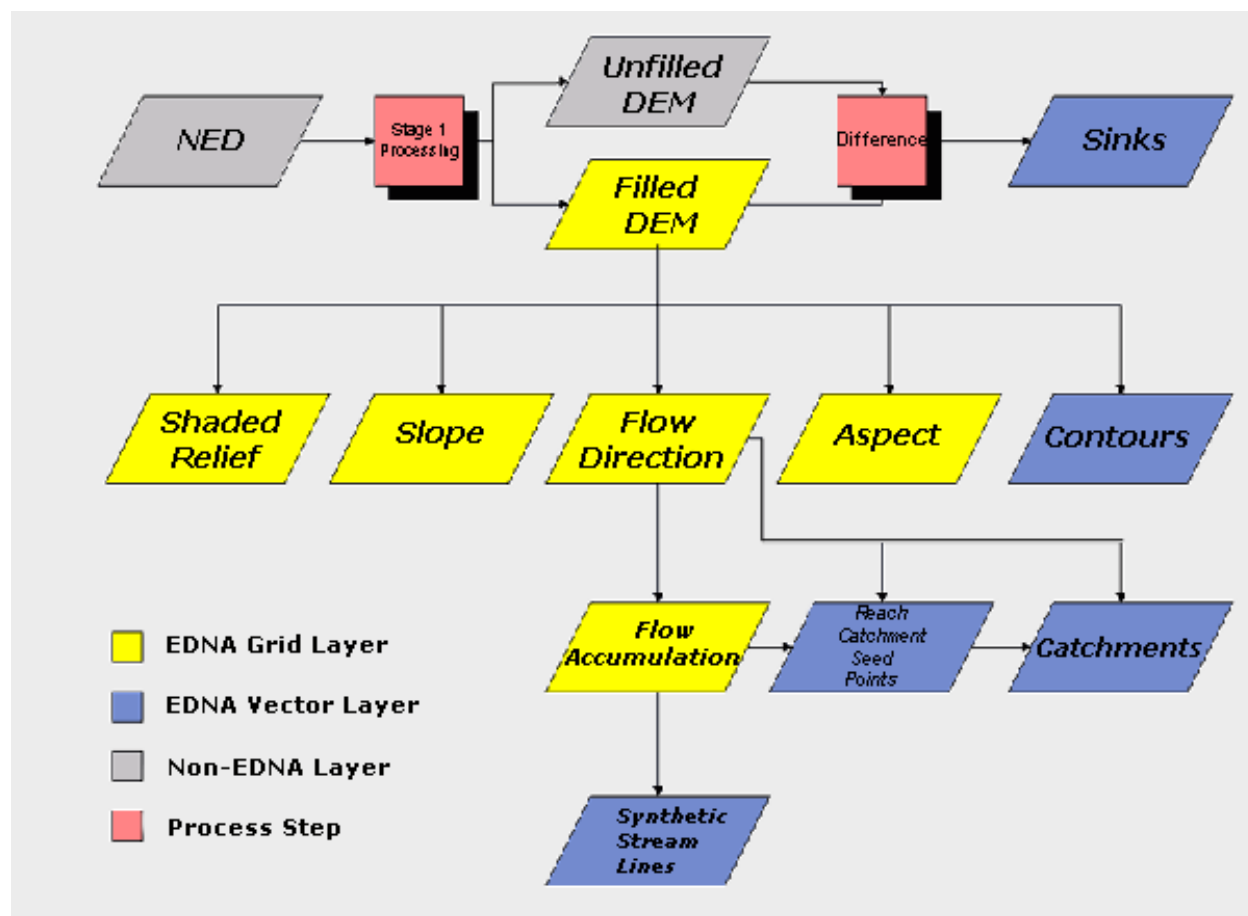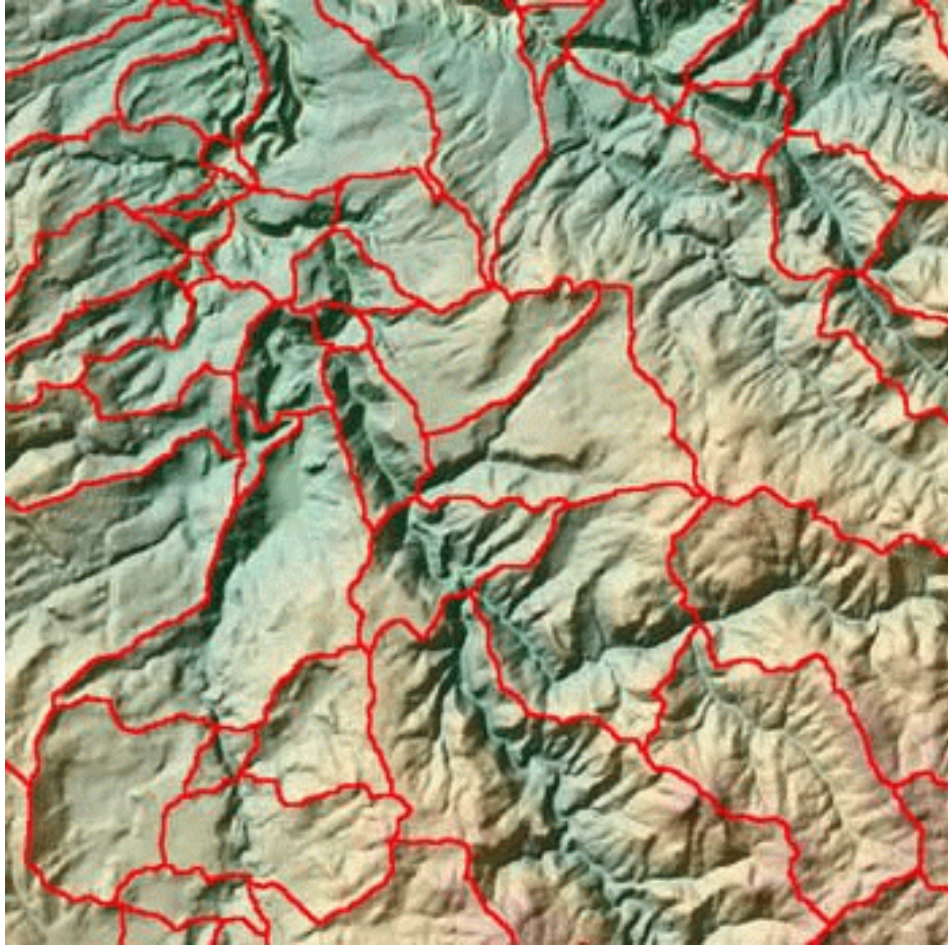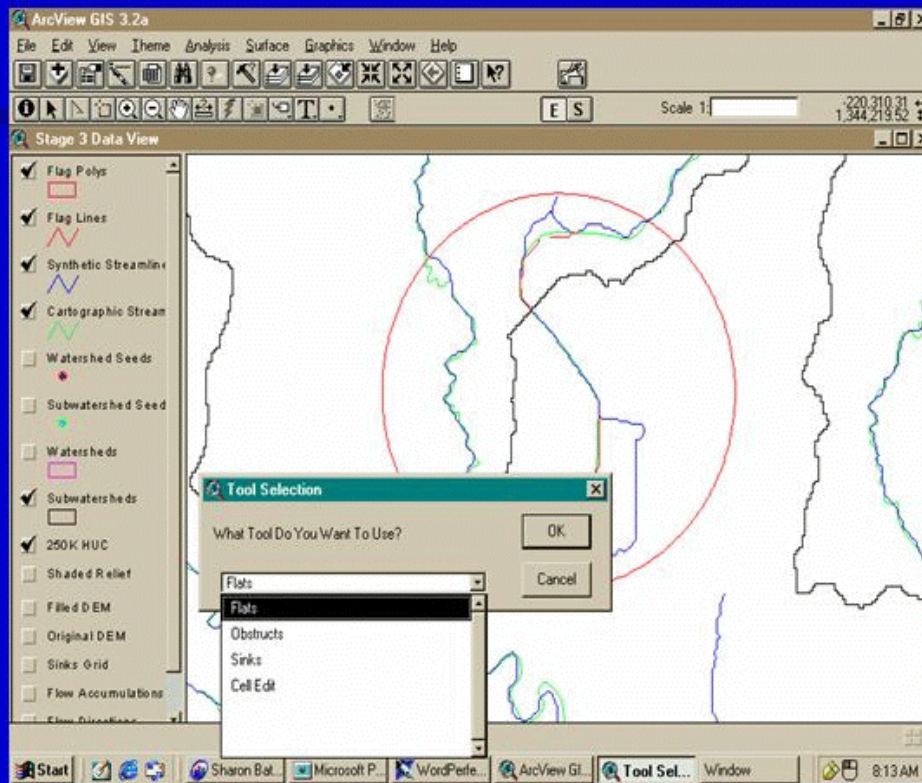

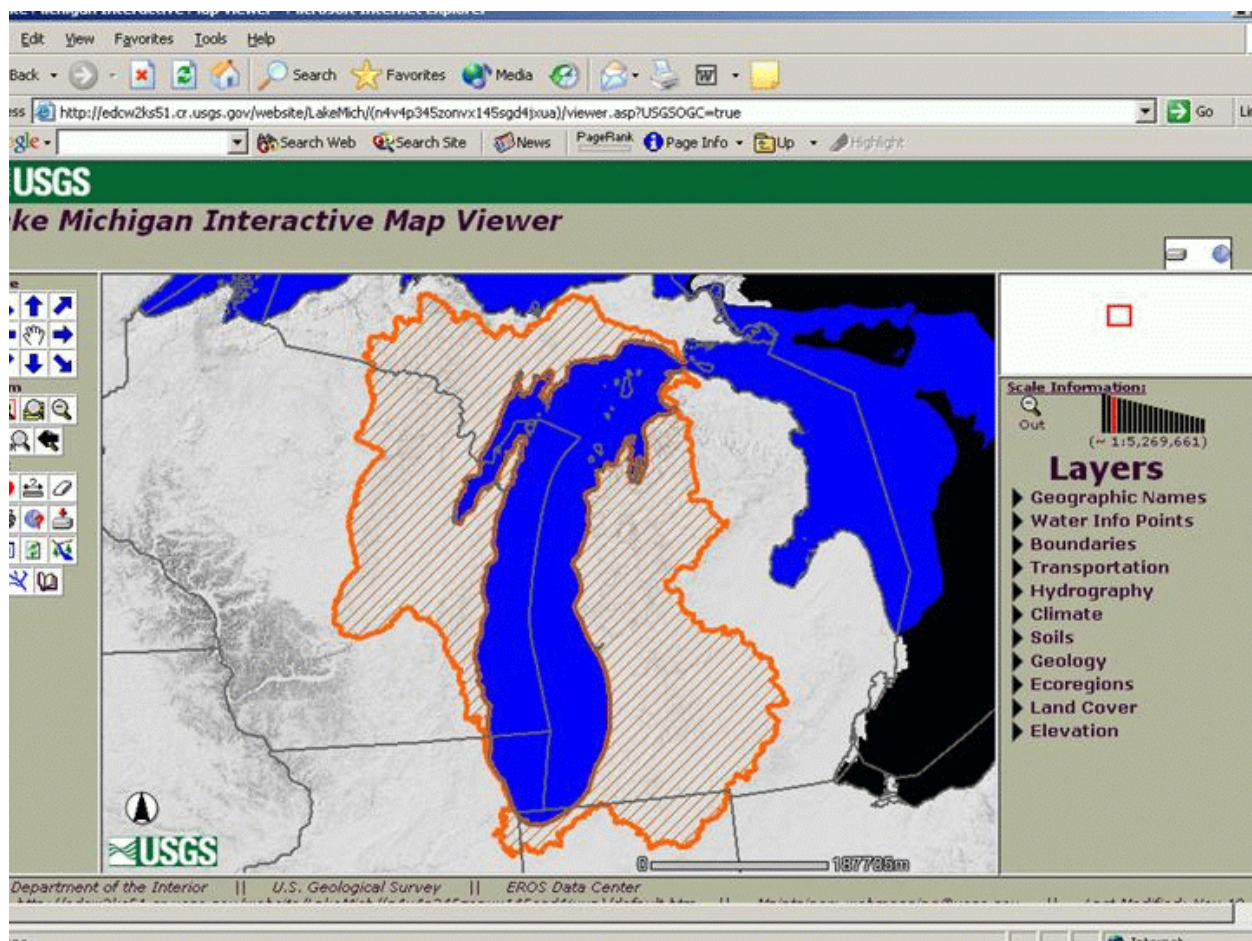Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Key Products

Detenbeck NE, Cincotta D, Denver JM, Greenlee SK, and Olsen AR. 2003. Watershed-based survey designs. Submitted to Environ Monit Assess (special issue).

Brown B, Detenbeck N, and Eskin R. (2003) Integrating 305(b) and 303(d): How EMAP Aids in Monitoring and Assessment of State Waters. Submitted to Environ Monit Assess (special issue).

Interactive web interface for Lake Michigan basin (edna.usgs.gov - Applications - Lake Michigan Viewer)

Verdin K. 2001. Efficient DEM Editing Tools for Integration of DEMs and Mapped Hydrography. 2001 ESRI User Conference.

edna.usgs.gov
http://gis.esri.com/library/userconf/proc01/professional/papers/pap730/p730.htm
http://gis.esri.com/library/userconf/proc00/professional/papers/PAP397/p397.htm

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